Study tour to learn how driving simulators are used overseas with older and medically impaired drivers and learner drivers with a disability.

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Signed Pamela Ross Dated 24/7/16
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Introduction

The purpose of the Churchill Fellowship was to learn about the types of driving simulators available for use in driver rehabilitation, how they are being used and funded in clinical settings with older and medically impaired drivers, and the evidence to support their use. This information will provide a valuable resource for recommendations about the benefits and potential use of driving simulators in driver rehabilitation services within Australia.

Simulators have been used for many years, in training programs with a variety of occupations including pilots, train and truck drivers. Car driving simulators have been used in some countries as part of the training program for novice drivers. There is growing interest in using driving simulators in the area of driver assessment and rehabilitation for medically impaired and older drivers. The ‘gold’ standard for assessing fitness to drive has been a comprehensive driver evaluation. This includes off-road clinical screening assessments, followed by a practical on-road evaluation in a dual controlled car in real traffic. In Australia, Occupational Therapy Driver Assessors (OTDAs) with knowledge of how medical impairments can affect fitness to drive, are recognised as ‘experts’ in the area of driver assessment and rehabilitation.

Driving simulators are being used in some driver rehabilitation programs overseas, to assist, with both evaluation and re-training of drivers with medical impairments, however they have not yet been used in clinical settings in Australia. I commenced working as an OTDA in 1987, after completing the first OTDA training course in Australia. In 2014, the driver rehabilitation program at Epworth Rehabilitation, Melbourne, Australia, where I am employed, was fortunate to have funding donated to purchase a driving simulator. Due to a lack of Australian based simulator suppliers, it was difficult to determine what types of simulators were available and what selection criteria were important. In addition, there was a lack of evidence to describe or support their use with medically impaired drivers. A car driving simulator (Eca-Faros Ultra-2) was purchased in 2015 and the journey to learn about simulators has been made possible with the generous support from the Churchill Fellowship.

Acknowledgements

Many people and organisations have contributed in a variety of ways to enabling me to undertake this study tour. I would like to extend my thanks and appreciation to the following:

- The Winston Churchill Trust for making it possible.
- Dr Marilyn Di Stefano for encouragement and professional support to apply for a fellowship and subsequent words of wisdom while planning the fellowship.
- Anne Sutherland, Occupational Therapy Manager at Epworth Rehabilitation for her personal and professional support of my application and to the colleagues who covered my caseload in my absence.
- The clinicians who demonstrated their driving simulators, allowed me to observe sessions and discuss work practices and the researchers who generously shared their research findings, plans and showed me their simulator labs.
- My family, particularly my husband, who provided support with the travel plans and technology that made my trip so much easier.
Executive Summary

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Highlights of the Fellowship
My personal highlights included:
- Meeting and observing driver rehabilitation specialists from other countries, seeing the facilities they work in and learning about their driver rehabilitation programs.
- Attending the American Occupational Therapy Conference with 10,000 other OTs.
- Meeting some of the key researchers, whose work I had read.
- Attending the Mobility Road Show in the UK.
- The opportunity to try out a range of driving simulators and talk to the suppliers.

Major Lessons and Conclusions
Driving simulators can make a valuable contribution to driver rehabilitation programs for both patients and occupational therapists. They offer experienced and learner drivers with a disability, the opportunity to practice or learn new driving skills and develop confidence in a safe and stress-free environment. Driving simulators fitted with a range of vehicle modifications can enable OTs to assess and train drivers in the use of adaptive equipment. However, they do not replace on-road driver assessment and training in real traffic. Australian’s with a physical disability have very limited options to try out a range of vehicle modifications compared to those in the USA, Canada, France and UK. The UK and US have driver rehabilitation centres with their own fleet of vehicles and specialised staff offering a range of services to provide a ‘one-stop shop’.

The main barriers to the widespread use of driving simulators in Australian health care centres are the initial purchase and potential access costs to patients. It is recommended that driver rehabilitation service delivery and road safety could be improved if specialised ‘driving’ centres, offering a coordinated ‘one-stop shop’ approach were available in Australia. The availability of the following resources and services would be recommended:

- Specialist OT driver assessors and driving instructors to provide driver assessment, driver rehabilitation and advice.
- Driving simulators fitted with vehicle modifications.
- Modified vehicles to provide a range of adaptive equipment options to enable assessment, training and the option to ‘try before you buy’.
- Programs offering driver assessment and driving-related advice for older drivers, including vehicle set-up and training to use assistive technology.
- Assessment and training program, using driving simulators for learner drivers with a disability to determine potential to drive and provide initial driver training.

May I take this opportunity to express my sincere gratitude and thanks to the Churchill Trust for providing this wonderful opportunity. The knowledge I have gained will assist me to contribute to these recommendations and is being applied in my clinical work. A range of opportunities to disseminate the knowledge are planned this year, including presentations to OTDAs, TAC, Rehabilitation doctors and at a simulation conference.
**Abbreviations used in report:**

CDRS – Certified Driver Rehabilitation Specialist (US, qualification based on an exam)
DRS- Driver Rehabilitation Specialist (US)
OTDA – Occupational Therapy Driver Assessor (Australia)
ADED – Association for Driver Rehabilitation Specialists
AOTA – American Occupational Therapy Association
TRIP – Test Ride for Investigation of Practical fitness to drive
DLA – Driver Licensing Authority
DVLA – Driver and Vehicle Licensing Agency (UK)
DMV – Department of Motor Vehicles (USA)
TBI – Traumatic Brain Injury
PTSD – Post Traumatic Stress Disorder
PD – Parkinson’s Disease
MS – Multiple Sclerosis
CP – Cerebral Palsy
ASD – Autism Spectrum Disorder
ADHD – Attention Deficit Hyperactivity Disorder
TAC – Transport Accident Commission
RACV – Royal Automobile Club of Victoria

**Program**

To achieve the goals of the fellowship, the following four types of visits/events were included in the program;

1. Meetings with driving simulator suppliers to learn about the types and features of simulators currently available for use in driver rehabilitation.
2. Visiting hospitals/ driver rehabilitation centres to meet the clinicians using the simulators, to observe how they are used with a variety of medical conditions, identify how they are funded and any simulator specific training the clinicians had received. It was also important to gain an understanding of the driver assessment and rehabilitation processes including communication of recommendations to the driver licensing authorities (DLAs).
3. Meetings with key researchers to discuss evidence for the use of driving simulators in driver rehabilitation, learn about current research projects and identify areas for further research.
4. Attend relevant conferences/workshops: 1) American Occupational Therapy Conference (AOTA), to meet with the driving simulator suppliers exhibiting their products 2) World Congress in Neurorehabilitation to attend a workshop on driver evaluation and rehabilitation and attend the International driving special interest group. Both conferences provided the opportunity to learn about current issues and research relevant to driver rehabilitation and meet researchers and clinicians working in this area.
The decision to visit USA, Canada, France and UK was based on a number of factors including, where the driving simulator suppliers and relevant researchers were located, where they are being used in clinical practice, and the opportunity to attend relevant conferences/events. The details of the final fellowship tour are outlined in the table below:

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Organisation/Event</th>
<th>Contacts</th>
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<tbody>
<tr>
<td>4th April</td>
<td>Los Angeles USA</td>
<td>VA Medical Centre</td>
<td>Eddie Duag – Kinesiotherapist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>California State Rehabilitation Centre – Mobility Evaluation Program</td>
<td>Kathie Bobbit – Adaptive Driving Evaluation Specialist</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rancho Los Amigos National Rehabilitation centre</td>
<td>Sandra Okada OT Driver Rehabilitation Director, CDRS</td>
</tr>
<tr>
<td>6th April</td>
<td>Chicago USA</td>
<td>American Occupational Therapy Association Conference – attended a relevant presentations and poster sessions</td>
<td>Driving simulator suppliers OT driving researchers – Prof Anne Dickerson Elin-Schold Davis Liz Greene – ADED Dr Ann Helen Patomella</td>
</tr>
<tr>
<td>to 10th</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>April</td>
<td>Wheaton Chicago USA</td>
<td>Marionjoy Rehabilitation Hospital</td>
<td>Anne Hegberg CDRS</td>
</tr>
<tr>
<td>11th April</td>
<td>Toronto Canada</td>
<td>Toronto Rehabilitation Institute</td>
<td>Prof Geoff Fernie Dr Jennie Campos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presented to staff</td>
<td></td>
</tr>
<tr>
<td></td>
<td>London, Ontario, Canada</td>
<td>Occupational Therapy School Western University</td>
<td>Dr Sherrilene Classen Dr Liliana Alverez</td>
</tr>
<tr>
<td>13th April</td>
<td>Lincoln Nebraska USA</td>
<td>Madonna Rehabilitation Hospital</td>
<td>Linda Storz - CDRS Lisa Anderson - CDRS</td>
</tr>
<tr>
<td>15th April</td>
<td>Augusta Georgia USA</td>
<td>Augusta University</td>
<td>Dr Hannes Devos Dr Maud Ranchet</td>
</tr>
<tr>
<td>20th April</td>
<td>Gainesville Florida USA</td>
<td>University of Florida</td>
<td>Dr Sandra Winter</td>
</tr>
<tr>
<td>21st April</td>
<td>Richmond Virginia USA</td>
<td>Hunter Holmes McGuire VA Medical Centre</td>
<td>David Martinez – CDRS Kinesiotherapist</td>
</tr>
<tr>
<td>5th May</td>
<td>Bethesda Maryland USA</td>
<td>Walter Reed Military Medical Centre</td>
<td>Tammy Phipps - CDRS</td>
</tr>
<tr>
<td>10th May</td>
<td>Philadelphia Pennsylvania USA</td>
<td>World Congress Neurorehabilitation – Medical Aspects of Fitness to Drive Workshop</td>
<td>Dr Carole Hawley - UK Dr Shawn Marshal - Canada Dr Hannes Devos - USA</td>
</tr>
<tr>
<td>11th May</td>
<td>Philadelphia Pennsylvania USA</td>
<td>World Congress Neurorehabilitation- relevant presentations and papers</td>
<td>Met; Prof Abioden Akinwuntan, Uni. Of Kansas Driving simulator researcher</td>
</tr>
<tr>
<td>to 13th May</td>
<td>Philadelphia Pennsylvania USA</td>
<td>World Congress Neurorehabilitation- relevant presentations and papers</td>
<td>Met; Prof Abioden Akinwuntan, Uni. Of Kansas Driving simulator researcher</td>
</tr>
<tr>
<td>12th May</td>
<td>Drexel University</td>
<td></td>
<td>Assoc Prof Maria Schultheis Department of Psychology</td>
</tr>
<tr>
<td>17th May</td>
<td>Evreux France</td>
<td>Hospital La Musse Presented to staff and OT students</td>
<td>Mr Yves Prudent OT Manager/driving specialist</td>
</tr>
</tbody>
</table>
19\textsuperscript{th} May
Lannion France
Eca-Group
Bertrand Saint-Jalme – Sales Engineer, Driving Simulation
Michel Bernard – Engineer, Driving Simulation

23\textsuperscript{rd} May
Derby, UK
Derby DrivAbility
Kingsway Hospital
Elizabeth Whiteman – OT Lead Clinician/Centre Manager

25\textsuperscript{th} May
Nottingham University UK
Nottingham University
Dr Kathryn Radford
Dr Nadina Lincoln

26\textsuperscript{th} & 27\textsuperscript{th} May
Silverstone Grand Prix Track UK
The Mobility Roadshow – attended older driver seminar
Met; Chris Lofthouse RICA Scottish OTs
Ed Passant – Driving Mobility

**Key Findings**

The three main aims of the Churchill Fellowship were to:
1. Identify the types of driving simulators used in driver rehabilitation and the suppliers.
2. Learn how they are being used and funded in driver rehabilitation programs with a range of medically impaired drivers.
3. Learn about the research supporting their use.

The findings from each of the organisations are reported below with an overall summary of the main findings from my visits to the driver rehabilitation programs and the researchers.

**1. Driving Simulators Suppliers**

From searching the internet and reading the driving simulator research with clinical populations, a number of driving simulator suppliers/manufacturers were identified. Only the suppliers of driving simulators that were designed for use in driver rehabilitation, rather than for research purposes were contacted, prior to the fellowship. The following list includes the main suppliers but is not intended to be a complete list:

1. Systems Technology Inc, Hawthorne California (STISIM simulators)
2. Drive Safety Salt lake City Utah - Drive Safety
3. Virage Simulation, Montreal, Quebec, Canada
4. Eca-Group, Tulsa, Oklahoma, USA (STARS simulator)
5. Eca-group, Lannion France
6. Carnetsoft, Groningen, The Netherlands
7. Doron, Binghamton, New York, USA
8. Forum 8, Japanese based company with office in Sydney Australia

Suppliers 1 to 4 were exhibiting at the American Occupational Therapy Conference (AOTA) Chicago, USA and recommended inspecting their simulators at the conference, rather than visiting their premises. Eca-Group also suggested visiting their showroom and factory in Lannion, France as different models are available for the European market. Suppliers 6 and 7 were not able to support a visit to their premises and supplier 8 has an office in Australia.
Although they are not being used clinically in Australia, one of their driving simulators was viewed at a local university prior to the fellowship tour.

2. Driver Rehabilitation Programs

The driver rehabilitation programs were chosen based on recommendations from driving simulator suppliers, colleagues and researchers. Attempts were made to visit programs funded by different sources, using a range of driving simulators and servicing a variety of medical conditions. A number of centres that did not use a driving simulator were also included to find out why.

Military Medical Centres

There are 48 driver rehabilitation centres in the USA established by Veterans Affairs (VA) to provide a service to eligible veterans and active duty personal. The driver rehabilitation programs are generally staffed by kinesiotherapists (KT) rather than OTs. On-road assessment and training is completed without the assistance of a driving instructor. A range of conditions are referred including amputation, stroke, older drivers with cognitive decline, multiple sclerosis (MS), Parkinson’s Disease (PD), traumatic brain injury (TBI), multi-trauma, psychiatric, spinal cord injury and vision impairment. The driver assessment and any vehicle modifications and training are paid for by VA. If the illness or injury is not service related, VA covers the training costs but not the adaptive equipment. I visited three military medical centres. All of the driving simulators in the US use automatic transmission, reflecting the driving preference in the USA.

A) Long Beach VA California

The program is staffed by two KT’s. They use a Drive Safety simulator with a Ford Focus cab, with working dash board, including fan and radio. It has been customized to include five
large 60 inch screens to provide a more ‘immersive’ environment. It is used as part of the pre-driving assessment, which also includes assessment of vision using the Optec 5000 and some cognitive and physical tests. The driving simulator exercises are chosen according to the patient’s diagnosis. For example patients with acquired brain injury complete a pre-specified protocol of interactive exercises designed to assess some of the visual, physical and cognitive skills required in driving, and reaction time. Patients then complete a range of scenarios on the simulator including basic driving tasks, such as lane keeping, left/right turns and merging. Advanced driving tasks such as changing lanes, speed control are then introduced followed by longer naturalistic drives. Patients are then assessed on-road in real traffic and most of the training (especially for adaptive equipment) is provided by the therapist in one of six vehicles (including vans with variable steering and high-tech adaptive equipment options).

B) Hunter Holmes McGuire Medical Centre, Richmond, Virginia

The program is currently staffed by one KT using a Virage simulator (4 years old) with working dashboard, motion platform and blind spot monitors (see photo below). The simulator has a ramp to provide wheelchair access and is fitted with adaptive equipment. It is mainly used for driver training and to familiarise patients with hand controls. It is not used as part of the pre-driving assessment. The decision to proceed to on-road assessment is based on the results of vision, physical and cognitive tests. Most training is done on-road, using one of four cars or two vans, with a variety of adaptive equipment.

C) Walter Reed National Military Medical Centre, Bethesda, Maryland

The driver rehabilitation program is run by an OT, who had a driving simulator but did not use it. She reported that it did not contribute to the assessment or training process; patients still needed to complete real world driving, which provided a functional assessment and was a more efficient use of time. In addition, she reported that simulators do not provide information about driving experience/skills. For patients with TBI, amputee and spinal cord injuries, who may have difficulties with dizziness, vestibular problems, sitting balance and
tolerance, the simulators do not have realistic motion and inertia, to adequately assess the impact of these issues when driving. She also assesses patients with dementia, PTSD and other mental health issues, but prefers real world driving. She completes a comprehensive off-road assessment followed by very comprehensive on-road assessments and training programs in one of three vehicles with a range of adaptive equipment. TBI patients must pass five out of five drives, including an extended 90 minute drive. Additional cognitive demands are assessed, including driving under time pressure and following a pre-planned a route where a GPS can be used.

California State Rehabilitation Centre – Los Angeles, California

The Mobility Evaluation Driver Rehabilitation Program is part of the state funded Vocational Rehabilitation Service, and is the only one in California. Vehicle modification/equipment are funded if clients meet eligibility criteria and are work ready. The client must purchase the vehicle. They do not use a driving simulator. A screening assessment is completed by an OT using an older brake reaction tester in combination with other tests. The service specializes in high-tech vehicle adaptations and has a fleet of eight specially modified vehicles. All training is completed on-road with a very experienced and specialized driving instructor, who works in combination with the OT and a Rehabilitation Engineer to develop, design and customize the vehicle modifications to suit each individual.

Rancho Los Amigos National Rehabilitation Centre – Los Angeles, California

The hospital is funded by the county. The Honda motor company provides a donation each year, enabling the program to see low income clients who could not otherwise afford to pay for the driver assessment. The driving program is staffed by OTs and two driving instructors. They have a ten year old, Skills Testing Assessment and Rehabilitation Simulator (STARS) with three x 19 inch screens. It sits on a desk top, has hand controls and left foot accelerator
pedal, and a button is pressed for the side mirror view. It is used as part of the pre-driving assessment with a wide range of diagnoses, including novice drivers with cerebral palsy, developmental delay, Spina Bifida, Attention Deficit Disorder and Autism Spectrum Disorder. A protocol is followed to allow patients to become familiar with the simulator, and a range of scenarios are used both for assessment and training purposes including risky driving scenarios requiring adjustment of speed for slow moving vehicles, overtaking a bus and changing lanes to avoid road works. On-road assessment and training are conducted by the OT and driving instructor with the driving instructor maintaining vehicle safety. They also offer a Car fit program for older drivers which is run in conjunction with volunteers from the American Automobile Association to provide advice about correct vehicle set up and to discuss community mobility options for seniors who may be unable to continue driving.

Marionjoy Rehabilitation Hospital – Wheaton, Illinois

The driving program is staffed by five OTs (all CDRS qualified) and has a reputation for expertise in high-tech vehicle adaptations. A wide range of diagnoses are assessed, including older drivers, those with spinal injuries and novice drivers with a disability, who are funded by their school. Other funding sources include Vocational Rehabilitation Service and many are self-funded. They do not have a driving simulator, but use a range of static rigs (photo below on right) where patients can try different hand controls, spinner knobs and an adjustable height bench with variable effort steering to increase or decrease the resistance prior to on-road driving (photos below on left). A range of vision and cognitive assessments are completed prior to on-road assessment, which is completed by the OT. They conduct a great deal of on-road training, commencing in the quiet hospital grounds and progressing to real world traffic. They have six vehicles – including one set up for low tech, one for high tech, and other cars (sedan, SUV) – all with dual controls. They also offer a Car fit program for older drivers and have a dedicated room with resources to provide advice to older drivers.

Toronto Rehabilitation Centre

The centre is in the process of setting up their driving program after a period of being unavailable. An older simulator was previously used by OTs to assist in determining who should be referred for formal on-road assessment. There were frequent maintenance issues, which were difficult to resolve. They are now purchasing a STISIM desk top simulator to
replace it. Until their service is running again, patients are referred to private OT driver assessors who work with driving instructors. The assessments are self-funded or by workplace or motor vehicle accident insurance. Main diagnoses are stroke, TBI and older drivers, but they intend to use the simulator in the mobility, concussion and upper extremity clinics as both an intervention and for screening.

**Madonna Rehabilitation Hospital, Lincoln, Nebraska**

The hospital is part of the Catholic Diocese of Lincoln and offers a driver rehabilitation program staffed by two OTs (CDRS). They use a two year old STISIM driving simulator, which replaced an older simulator that continually broke down. The equipment was funded by donations to Madonna from the foundation, which also subsidizes the program. Sessions are billed through insurance (Medicaid, state, private insurance or self-funded). If eligible, car modifications may be funded by Vocational Rehabilitation. Driving lessons are out of pocket expenses and both the evaluation and driver training are conducted by the OTs, using a sedan or modified van. They may refer to a driving school for those requiring a lot of driving practice. Referrals include seniors and learner drivers, patients with low vision and visual field loss, TBI, stroke and spinal injuries.

The driving simulator is often used for pre-driving practice and as a therapy tool prior to referral for driving assessment. It is not used to ‘assess’ driving, but is part of the pre-driving assessment, in conjunction with other clinical tests. A simulator protocol for pre-driving screening is followed. This includes warm-up drives which can be graded in complexity, brake reactions, steering reach and hazard perception. The simulator instruction manual is available on the computer desk top enabling other staff to use it. When used as an intervention, scenarios are used to address specific deficits identified during the on-road assessment. Instruction and practice in overtaking, gap selection, merging, and behaviours such as following directions, divided attention and attention during longer drivers can be targeted using the simulator. Patients are asked about simulator sickness during the sessions.

**Augusta University Driving Clinic, Augusta, Georgia**

The university has two driving simulators using STISIM software - one for research and one for clinical use. The clinical simulator is housed in a car (see picture at right) and scenarios are controlled from a separate room. Many of the scenarios were created by Dr Abioden Akinwuntan (now at Kansas University) and Dr Hannes Devos, both physiotherapists and DRS. The car has a left foot accelerator, steering knob and hand controls, but can be difficult for patients to get in and out of. It is used as part of the comprehensive pre-driving screen and then as an intervention for
training. Around 50% of referrals are patients with stroke. The remainder are comprised of mild cognitive impairment, multiple sclerosis and Parkinson’s Disease. Patients only progress to the simulator if scores are adequate on the clinical tests.

A protocol is followed commencing with a familiarization drive with straight roads with minimal clutter to minimize the chance of simulator sickness. Complexity of the traffic environments is gradually increased, before progressing to a nine mile published evaluation route which includes hazardous events such as children running out, road works, and an accident scene. Complex brake reaction times are also assessed and scores compared to normative data. A simulator sickness questionnaire is administered after the familiarization and evaluation scenarios.

If driving skills are assessed as adequate on the simulator, the patients then progress to on-road assessment with a driving instructor. A standard on-road route is used which is scored using the Test Ride for Investigation of Practical fitness to drive (TRIP). The simulator is also used for re-training of skills to target issues that were observed on the TRIP or the pre-driving assessment. The play back option can be used to help develop insight. Patients usually have to self-fund and this can be a significant barrier, so costs are deliberately kept low.

La Musse Rehabilitation Hospital, near Evreux, France

La Musse is a private rehabilitation hospital set on 35 hectares offering outpatient services including a driver rehabilitation program. The hospital purchased an Eca-Group simulator in 2006. (Pictured on the right) It has five large screens, enabling 120 degree field of view including blind spot view. It is located in a Renault car body and the OT sits in the passenger seat during the sessions to provide instructions and control the scenarios. It is used for assessment and to provide training to use adaptive equipment. A protocol is followed, including physical assessment of ability to transfer in and out of the car and use the controls and reaction times. Clinical neuropsychology tests are completed and the patients receive 60 minutes of practice to familiarize to the simulator and evaluate tendency for simulator sickness, prior to assessment. On-road assessment using scenarios of graded complexity are scored using the TRIP. Patients are often referred to a local driving school for training. Occasionally the OT may do on-road assessment with a driving instructor. The cost of the assessment is included for hospital patients but external patients must pay.

Derby DrivAbility at Kingsway Hospital, UK

Derby DrivAbility is one of the 17 accredited centres, that comprise Driving Mobility UK that offer advice and assessment to individuals with a medical condition that may affect
driving or access into a motor vehicle. They offer a range of services including driving and passenger assessment, wheelchair/scooter assessment, restraints and seating for children with behavioural issues, tuition and retraining. Different services are offered depending on skills of staff. Some are charitable organisations and some operate within the National Health Service. Charges vary and in some circumstances there is no cost. If referred by the Driver and Vehicle Licensing Agency (DVLA), Motability or NHS, then the relevant organization pays. OTs, working with specialized driving instructors employed by the centre, conduct the off-road assessment and usually conduct the on-road test with the driving instructor. None have driving simulators. They have been considered too expensive, although this may be reviewed. They were all issued with a ‘rig’ around 15 years ago. It can be used to assess simple and complex reaction time and lower limb strength and accelerator control. It is fitted with adaptive equipment including hand controls, left foot accelerator, a toggle accelerator, an over ring and various steering knobs.

A range of pre-driving assessments are used, as recommended by Driving Mobility. The on-road assessment consists of driving a standard route, graded in complexity. The centre has a fleet of ten vehicles for assessment and rehabilitation purposes. Automatic and manual transmission and a range of adaptive equipment are available on the cars. A wide range of diagnoses is seen at the centre, however the staff reported that the numbers of referrals of older drivers with mild cognitive decline has been steadily increasing.

**Summary of findings from visits to clinics**

Driving simulators are being used with a range of diagnoses in clinical settings, mainly in the US. They are not used in the UK and it is difficult to know how widespread their use is in Canada and France. Each centre follows it’s own protocol or follows the suggested protocol available on the simulator. This usually included a period of driving to enable familiarization to the simulator, followed by a range of scenarios designed to test various driving related skills and cognitive abilities required for safe driving. In some centres, performance on the simulator contributed to the assessment outcome, but a fitness to drive decision was not based on this alone. An on-road driver assessment remains the preferred method to assess driving competence.

Most centres used the simulator for training of specific driving skills that were assessed to be a problem during on-road assessment, such as lane-changing or merging. They were also used to train drivers with a physical disability to use adaptive equipment or to assess and train learner drivers with a disability.

A range of disadvantages of driving simulators were reported by clinicians:

- simulator sickness, which is worse with older drivers.
- the ongoing costs for simulator maintenance issues and for software upgrades.
- patients don’t regard them as a valid assessment of real world driving.
- the expense of the simulator must be weighed up against using the funds to employ additional staff or buy a modified vehicle.
- additional time is taken when using the simulator as part of the assessment. It was more efficient to use the time to complete the on-road assessment.
3. Research facilities and Researchers

Toronto Rehabilitation Institute - iDAPT Centre for Rehabilitation Research

The iDAPT centre comprises eleven research teams, each with a different focus. The overall goal is to develop strategies and devices to prevent injury and illness and improve medical treatment. Staffing includes researchers and design engineers. I met with the Driver lab team under the direction of Professor Geoffrey Fernie. They are in the final stages of building a world class motion simulator which will be a gold standard simulator. It features a 360 degree field of view, surround sound to replicate tyre, traffic and engine noise and glare and weather simulation. A full size car on a motion base is located within the lab which is also on a motion platform. (see photos below). A number of research projects are planned, some in conjunction with the Ministry of Transportation in Canada. They include investigating whether on-road safety improves in older drivers following simulator training, the effects of Opioid drugs on driving capacity in individuals with chronic pain and comparing the validity of results obtained on this high fidelity simulator with results of driver performance on low fidelity simulators (which are mainly used in driving clinics).

School of Occupational Therapy Western University, London, Ontario, Canada

The lab is under the direction of Dr Sherrilene Classen using a Drive Safety desk top model simulator (photo on left) for research purposes. It was chosen due to: its’ affordability, it can be adjusted to suit a variety of populations, the supplier/manufacturer was keen to collaborate with scenario development and provided excellent service. It has three x 19 inch screens which seems to result in less simulator sickness than the larger screens. Dr Classen has also used STISIM software in previous research projects at University of Florida. The lab has three rooms; One for the simulator equipped with air
conditioner and fan to minimize simulator sickness, a room to conduct the pre-screening assessments and a room where researchers/parents/students can observe. The pre-driving assessment protocol varies according to the age group and diagnosis. For research purposes, the observational data of performance generated by the driving simulator is based on seven specific errors such as signaling, gap selection, visual scanning, vehicle position and adjustment. More detailed data, including standard deviation of lane position errors and headway are also obtained. The simulator contributes to the pre-driving screening but has not been found to be predictive for fitness to drive. A number of research projects are underway using the driving simulator and a validation study for an app to train hazard perception in novice drivers with a disability is also being conducted.

Augusta University

The driver rehabilitation lab is currently under the direction of Dr Hannes Devos. A STISIM simulator with three x 19 inch screens and Logitech steering wheel and pedals, mounted on a bench top is used for research purposes. It is housed in a room kept at 68°F (20 °C) with ability to dim the lighting and link optical scanning equipment. Advantages of STISIM were reported to be its versatility, good after service and the scenario definition language is the easiest to learn. A number of research projects investigating driving simulator training with stroke, multiple sclerosis and stroke have been published (see references below). Current projects include investigating visuo-ocular function in Parkinson’s Disease and visual fields in glaucoma. Specific scenarios have been developed and graded according to clutter, dynamic (movement) and activity requirements. Another study is investigating eye tracking in driving after concussion at 24 to 48 hours after symptoms have resolved, in a group of high school students.

University of Florida

The lab at the University of Florida has four driving simulators. A variety of published research projects have been conducted using the simulators, by OTs, Dr Sherrilene Classen (prior to moving to London University) and currently by Dr Sandra Winter. A Drive Safety simulator is located in a wheelchair accessible Dodge truck for use with Veterans with TBI and PTSD and can be transported to participants. A second simulator using STISIM software located in a real car with scenarios projected on to large screens will soon be replaced with one from Real Time Industries. This simulator can be programmed and will have customized scenarios including real world intersections and advanced assistive technology. This technology includes connective features where information between cars at an intersection is shared, to enable automatic adjustment of speed to assist traffic flow. Technology related to autonomous cars, will also be available on the new simulator. It will be used in a project funded by the US Transportation Centre with both older and younger drivers. The third simulator is a Drive safety CDS 250 with a car cab (see photo
above) and adaptive equipment. A fourth simulator, a Drive Safety 250 on wheels, used for a study on epilepsy, could be wheeled into patient’s rooms. The manufacturer has worked with the researchers to develop customised scenarios, which have been funded by the relevant research projects. Dr Winter has designed data collection forms to record type, number and location of errors observed during scenarios.

**Drexel University**

Dr Maria Schultheis, is a neuropsychologist who has been conducting simulator research for many years and is now using the 4th version of a driving simulator that she has developed. She was not satisfied with the cost of the commercially available simulators and prefers to create her own scenarios using Digital Media Works. The simulator sits on a bench, has three x 19 inch monitors and uses a gaming steering wheel and pedals. It does not have any adaptive equipment, rear vision or side mirrors. She has completed research on a variety of patient groups including TBI, Autism and stroke and into the impact of tasks such as texting, turning on a radio and paying tolls, on driver performance. Basic training and familiarization using a highway scenario is provided, followed by a scenario of about 40 minutes designed to be graded to replicate an on-road assessment. The drive includes a school zone, commercial, residential, and highway (rural) environments. Events are programmed to occur along the route including a ball rolling out with child following. Simulator sickness is checked for, but has not generally been a significant issue, except in women aged over 60.

**Nottingham University**

I visited Dr Kate Radford (OT) and Professor Nadina Lincoln (neuropsychologist) who developed the Stroke Driver’s Screening Assessment (SDSA) and are currently trialing a screening assessment for dementia. Although Nottingham University has three driving simulators (called NITES 1, 2 and 3; Nottingham Integrated Transport Environment Simulator), none have been used in research with medically impaired populations at this stage. NITES 1 is a high fidelity simulator on a motion platform and has a 360 degree view. The same scenarios can be played on NITES 2 which is a lower fidelity simulator to compare driver performance.

They third simulator is new and located in a real car with the engine removed, but electronics retained to enable the fan, radio and electric windows to work (see photo below). STISIM software is used and scenarios are projected on to three large screens. In addition, a monitor is located at the rear of the car to provide an image in the rear view mirror and the side mirrors show the side view. They are programming their own scenarios. Much of the research to date has been conducted by The Human Factors Group into driver distraction and to provide advice regarding car design to vehicle manufacturers.
Summary of findings from visits to Research Facilities

The visits to the research facilities enabled me to see both high and low fidelity simulators. The driving simulators used with patients in driver rehabilitation program are the lower cost low fidelity simulators. The higher cost, high fidelity simulators are more commonly used for research purposes. Evidence from the research into using driving simulators for evaluation and rehabilitation of driving with a range of medical conditions is still limited, as it is a relatively new area. It was pleasing to find that there are currently many projects in progress, which will continue to contribute valuable findings.

Researchers reported a number of challenges commonly encountered in research using driving simulators. It can be difficult to assess driver performance on the simulator as participants need time to adapt to the simulator without impacting on scenario validation. In addition, further research is needed to validate whether the results achieved on a high fidelity simulator can be applied to low fidelity simulators. Another challenge was the variability in the measures used to evaluate performance. Two types of data are collected from the simulator: 1) Measures of aggregate data such as the total number of violations (speeding errors, divided attention tasks) 2) The more detailed data such as standard deviation of lane position transgressions and time and headway distances. There is not yet a consensus as to the preferred data for research purposes.

Other challenges included managing simulator sickness. All researchers used a Simulator Sickness Questionnaire and a variety of techniques to minimize occurrence. These included; reducing air temperature, providing a fan for air flow, minimizing peripheral visual movement and clutter, plain walls and providing dry-ginger ale, mints or dry biscuits!
With regard to the evidence for the use of driving simulators with older drivers and patients with medical conditions the following brief summary is provided:

- For patients with Parkinson’s Disease (PD) there is evidence to suggest that using the driving simulator in the screening assessment in combination with clinical tests improves the accuracy of predicting safe driving. There is limited evidence that simulator training can improve on-road performance in PD.

- There are mixed findings for the benefits of using driving simulators to assess patients with multiple sclerosis (MS). On-road assessment is still recommended. Training sessions on a simulator showed promise and may have the potential to improve visual, cognitive and on-road skills in patients with relapsing-remitting MS.

- For stroke patients there is evidence that graded simulator interventions and on-road training can improve on-road performance. Driving simulators may contribute to the pre-driving evaluation but based on current evidence, on-road assessment is recommended.

- Simulator training has also been used as an intervention for returned combat veterans, with diagnoses of mild TBI and PTSD. Simulator training has been associated with a reduction in driving errors and improved lane maintenance.

- There is emerging evidence for their use as an intervention to train or rehabilitate driving skills. For example, providing simulator training with a focus on self-awareness, has been found to improve driving skills in older drivers.

- Adolescents with Attention Deficit Hyperactivity Disorder have also benefited from driving simulator training.

In summary, evidence from the research suggests that clients need training to use a driving simulator and then time to adapt. Until protocols are defined regarding simulator use in driver assessment and rehabilitation, driver performance should still be assessed by on-road evaluation. A number of useful research references are provided at the end of this report.
4. Events Attended

- American Occupational Therapy Conference (AOTA)
- World Congress of NeuroRehabilitation (WCNR)
- UK Mobility Road Show

**American Occupational Therapy Association (AOTA) Conference**

The AOTA conference was held at Mackillop Place in Chicago between Wednesday 6\textsuperscript{th} and Sunday 10\textsuperscript{th} April 2016. It was a highlight of the trip, as around 10,000 Occupational Therapists attended and I was able to attend many relevant short courses, scientific research and poster presentations. Most importantly, four of the main driving simulator suppliers were located in the EXPO hall, which provided the opportunity to meet them and learn about the features of each of the simulators. I also met a number of key occupational therapy researchers working in the area of driver rehabilitation and using driving simulators.

Some of the sessions attended included:

- Interactive Driving Simulators: Evidence for Use in Assessing Clients’ Driving Fitness  (Lauren Cochran; Anne Dickerson)
- Driving and Parkinson’s Disease: What Only Caregivers Can Tell Us.(Liliana Alvarez; Sherrilene Classen)
- Older Driver Initiative Update: Translation of Developed Pathways to Service Providers in Home and Primary Care: The Older Driver Initiative Expanded!  (Elin Schold Davis; Brian Chodrow; Ann Dellinger; Anne Dickerson).
- Driver Rehabilitation and Mental Health Practice: Occupational Therapy Addressing an Untraveled Road. (Eva Rodriguez; Sean Getty)
- Vision Therapy: More Than Just a New Pair of Glasses. (Gina Gallagher; Megan Dean).
- Comparing Wayfinding On-Road and in the Driving Simulator: Does GPS Improve or Impair Driving Performance? (Lauren Cochran; Anne Dickerson)
- P-Drive: Implementing an Assessment of On-Road Driving in Clinical Settings.(Ann-Helen Patomella; Anita Bundy)
- The Ethical Pathways to Address Seniors At Risk for Falls, Driving, and Community Mobility Elin Schold Davis; Felicia Chew; Ann Dellinger; Anne Dickerson; Deborah Yarett Slater; Susan Martin Touchinsky
• Exploring Strategies To Prepare Teens With Autism Spectrum Disorder for Driving: Outcomes of a Driving Boot Camp – Poster (Danielle Ozment, Rebecca Case, Anne Dickerson)
• The Transferability of Safe Driving Skills from Simulator to On-Road Performance: A Systematic Review of the Literature – Poster (Krista Poppe; Lisa Jaegers)
• CDS-200 Driving Simulator Norming Study – Poster (Sara Hess; Amy Bashore; Erin Stauffer; Scott Truskowski)
• Combat veterans’ strategies to manage risky driving and preferences for driving intervention - Poster (Sandra Winter)

9th World Congress of NeuroRehabilitation (WCNR)

The WCNR was held in Philadelphia from 10th -13th May 2016. Attendees included a range of health professionals such as doctors, neuropsychologists, occupational therapists and physiotherapists. The presentation topics were mainly concerned with neurological disorders such as stroke, multiple sclerosis, spinal injury and traumatic brain injury. A highlight of this conference was attending a pre-conference workshop on medical issues relating to assessing fitness to drive and the opportunity to become involved at an international level in in the driving special interest group. The purpose of this group is to develop evidence-based guidelines for fitness to drive assessments and rehabilitation interventions to be used internationally. This would assist clinicians in decision making in this challenging area and improve service delivery to patients. A number of key researchers in the area of driving simulation and driver rehabilitation attended these sessions, providing an opportunity to hear a range of views and have further discussion during the conference.

Mobility Road Show

The Mobility Roadshow was held at England’s historic Silverstone Race Track on 27th – 29th May (see photos below). It is has operated since 1983 and is organised by the registered charity- Mobility Choice. Drivers or non-drivers, passengers, adults or children, can compare and contrast a large range of mobility products and services, all in one location and the race track provides the ability to trial a range of modified vehicles. Provisional licence and non-licence holders with a disability can also test drive vehicles through the ‘Get Going Live Program’ which has been operating since 2011. It offers young people the opportunity to receive advice about driving potential and try out vehicles and modifications.
Personally, the road show offered me the opportunity to learn about the latest technologies and products for vehicle modifications and to attend a seminar on older drivers. The speakers were from a range of organisations, including RAC Foundation, Transport Focus, Energy Saving Trust, Centre for Driverless and Connected Vehicles and the General Medical Council. Of particularly interest were the presentations on electric cars and autonomous/driverless cars and the future benefits that this technology may provide for both older drivers and those with a disability who are unable to drive.

**Summary of Additional Findings**

In addition to learning about the use of driving simulators in driver assessment and rehabilitation, it was important to understand the differences in clinical practices and contexts in which they are used. I have learned that there are many differences in fitness to drive assessments, procedures, guidelines and training requirements both between and within countries. A number of these are outlined below:

**Pre-driving Assessment Procedures**

A doctor’s report is usually required for referral for driver assessment, although in the UK, this is not mandatory. Each clinic completed a different range of pre-driving screening assessments. Vision was mainly assessed using the Optec 5000 Vision Screener and/or Dynavision in the US. Cognitive screening tests varied in the US. More commonly used tests included Useful Field of View (UFOV), mini-mental state examination (MMSE), Montreal Cognitive Assessment (MOCA), Symbol Digit Modalities test, Figure of Rey and Stroke Drivers Screening Assessment (SDSA). Nearly all clinics used Trail Making Test (TMT) Parts A and B. The driving simulator was generally used to assess physical ability to drive and interactive tasks designed to assess brake reaction, divided attention and visual scanning contributed to the cognitive assessment. The Mobility Forum (UK) has recommended the following tests to screen for cognitive issues: Star cancellation, Trails A and B, MOCA, Rookwood (which includes the VOSP – Visual Object and Space Perception), Figure of Rey, Stroop Test and Clock drawing. Scanning, reaction times and divided attention were assessed using tests on their ‘driving rigs’ (see photo at left), where patients responded to randomly appearing lights. The results of the pre-driving screen contributed to the decision about fitness to drive, but most therapists completed at least part of an on-road assessment to confirm the decision. They reported that patients do not feel that they have had a ‘fair’ assessment unless their driving skills are assessed in real world traffic. On-road driver assessment therefore remains the preferred method for assessing fitness to drive in the UK.

**On-road Assessment Procedures**

The on-road procedures varied between clinics and according to the diagnosis and experience of the driver being assessed. For experienced drivers, a standard on-road assessment route, graded in complexity was used and often included commentary driving, emergency braking
and some navigation. For novice drivers or those learning to use adaptive equipment, the assessment was conducted on hospital grounds or an area with low traffic demands. In some centres in the US, the CDRS completed on-road assessments alone without a driving instructor. Some reported that they found it very stressful, due to the difficulty in observing the road environment to maintain safety and to record driving errors at the same time. As a result, they reported that they often avoided complex traffic or finished the assessment early. In Australia, on-road assessment is always conducted by an OT, accompanied by a driving instructor providing directions and maintaining vehicle safety. In the UK and US, sometimes the driving instructor completed the on-road assessment alone and therefore contributed to the decision about fitness to drive. The most common on-road scoring tool was the TRIP.

**Driver Rehabilitation and Training**

For patients who are assessed as not fit to drive, driver rehabilitation may be offered. Most centres offered on-road training either with driving instructors or conducted by the CDRS. Driving simulators were used to complement this training to address specific driving skills. For patients with PTSD, both on-road sessions and driving simulator were used. One CDRS combined off road interventions such as Dynavision and Interactive Metronome with on-road training. Some OTs working with novice drivers with a disability who did not have access to a driving simulator, felt that it would be a useful to use a driving simulator to provide basic training prior to on-road lessons. They felt it would be less stressful and safer for both the OT and the client.

**Reporting Procedures to Driver Licensing Authorities**

There was wide variability in procedures for reporting assessment results to the Driver Licensing Authority (DLA). In Victoria Australia there is a well-established relationship with the DLA, enabling OTDAs to report their recommendations from the driver assessment directly to VicRoads (DLA). In the US, communication with the Department of Motor Vehicles (DMV) varied according to the state. In Virginia, US, the report was forwarded directly to the DMV with license restrictions (including area restrictions and no interstate driving). Some states required a DMV test after the on-road assessment, whilst in other states, there was no pathway to forward recommendations to the DMV. Often the report was sent to the referring doctor who may or may not forward it to the DMV. It was therefore difficult to enforce license restrictions or a recommendation not to drive. In some states there was no requirement for specialist advice or assessment to determine competence in using adaptive equipment. Likewise in some US states and some cases in the UK, the patient may be advised not to drive, but they may choose not to comply. In France, if restrictions or modifications are required, the DLA inspector may conduct an inspection or require a practical demonstration of competence, prior to adding the restrictions to the license.

**Operator Training to use Simulators**

There are no specific courses to train DRS in the use of driving simulators with medically impaired drivers. In the US, simulator training for OTs has not yet been accredited with AOTA. Dr Sherrilene Classen is currently in the process of editing a text book about driving simulators for clinicians, to be published in 2017. The chapters have been written by key researchers and will provide a much needed resource. In addition, Dr Classen delivers guest lectures about the clinical use of driving simulators including best evidence for their use. In conjunction with other researchers, she organised a full day driving simulator workshop at the
ADED conference in 2015. Western University in London, Canada is offering a Master of Clinical Science (MClSc) in Driving Rehabilitation Therapy, which includes some training on driving simulators. Graduates of this program are qualified to be entry-level driving rehabilitation therapists working with medically-at-risk drivers. STISIM simulators offer an OT training package, and include an instruction manual on their simulators.

**OT and Driving Instructor Qualifications**

Training requirements for OTs working in driver rehabilitation programs vary considerably. In Australia OTs are required to complete an additional qualification prior to commencing work as an OT driver assessor. Driving instructors are required by the DIA (Driving Instructors Authority) to have completed a certificate IV in Transport and Logistics (Driving Instruction) but this does not include any education about working with medically impaired drivers.

In the US, OTs and driving instructors can work in driver rehabilitation without any specific training, however ADED offers a 2 day Introduction to Driver Rehabilitation Course. It provides education about program development and documentation, behind the wheel training techniques and introduction to adaptive driving equipment. Further exams can be taken to become a CDRS – Certified Driver Rehabilitation Specialist. No special training is required in France to work in the area of driver rehabilitation.

In the UK a course is offered through Driving Mobility at Chester University which is targeted at 2 levels: post graduate training for OTs and a certificate level for driving instructors. There is an association of specialist disability driving instructors in the UK (see photo on right)

**Selection Criteria for Driving Simulators**

The main types of driving simulators have been described above. It is important to note, that in order to make an informed decision about what type of simulator is likely to suit a particular facility, selection criteria may vary according to whether the simulator is to be used in a driver rehabilitation program with patients in a clinical setting, with novice drivers for education or for research purposes. For example, some researchers selected a simulator on the basis of ease of programming or the detailed data that could be obtained, whilst others considered that the simulator should be similar to those used in a clinical setting. Likewise, clinicians need to consider purchase and maintenance costs, whether wheelchair access, the options for manual/automatic transmission or what types of adaptive equipment are required and types of scenarios available. Key selection criteria have been identified based on discussions with the suppliers/manufacturers, clinicians and researchers and will be presented in September 2016 at the Simtech conference in Melbourne.
### Planned Dissemination of Findings

A number of opportunities have already arisen to disseminate some of the knowledge gained from the Fellowship Trip and others are planned as outlined below:

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<th>Opportunity</th>
<th>Description</th>
<th>Timeframe</th>
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| Disseminate knowledge at Epworth Healthcare      | Presentations to colleagues at Epworth Rehabilitation to educate about identifying and referring patients who would benefit from using the driving simulator | 15th June 2016  
30th June 2016  
14th July 2016  
Ongoing                                                  |
| Co-investigator with Monash University Researchers on project ‘Assessing the efficacy and efficiency of a driving simulator for driving rehabilitation following acquired brain injury’. | Project aim is to assess whether simulated driver training, prior to standard on-road driving assessment and rehabilitation, can improve pass rates and reduce the requirements for on-road training for people with ABI. (stroke and TBI) It is expected that journal articles will be published from the findings. | Estimated completion of project - 2018 |
| Review two chapters from Driving Simulator Textbook | Reviewed Chapters on Stroke and Other neurological conditions                                                                              | Completed                     |
| Presentation with Professor Carolyn Unsworth (CQUUniversity) to SimTech Conference in Melbourne | Presentation on ‘Considerations for selection of hardware and software to use in occupational therapy driver assessment and rehabilitation simulations with older and/or disabled drivers’. | September 2016                |
| Provide consultation and advice to researchers and clinicians | I have already met with two Australian OT researchers from different universities and have a request from a doctor from a third university to provide advice about simulator use and selection. | Ongoing                       |
| Collaborate with an existing program that provides an education program aimed at prevention of road trauma in secondary school students | Using a driving simulator students can experience the effect of texting, drink driving etc, on driver performance. To meet with possible key stakeholders, including (TAC) to promote the program within Australian schools. | Commencing August 2016         |
| Disseminate findings to Transport Accident Commission (TAC) | Arranged to meet with TAC representative for Vehicle Modifications to discuss use of driving simulators and other findings from trip, to improve vehicle modification prescription and access in Victoria. | August 2017                   |
| Invited to speak at Rehabilitation Medicine Society of Australia and New Zealand | Invited to present on returning to driving after TBI and Stroke – to incorporate use of driving simulators in these populations and to participate in a panel discussion around challenges to rural communities. | October 2016                  |
Major Conclusions and Recommendations

1. Driving simulator use is recommended in occupational therapy driver rehabilitation programs, as they offer a low stress and safe intervention. They also have the potential to reduce the number of on-road driving lessons required, particularly in the following areas:
   - Training to use vehicle modifications prior to on-road training,
   - To assess the potential for teenagers with a disability to learn to drive,
   - To improve confidence/reduce anxiety prior to on-road assessment.

2. There is currently a lack of evidence to support the use of driving simulators as a replacement for the on-road evaluation for assessing fitness to drive. However they can contribute to the pre-driving screening assessment to assist in determining which drivers would benefit from a practical on-road evaluation.

3. There is limited evidence to support using driving simulators to improve on-road performance in healthy older drivers. Simulator sickness is a significant issue in this population and may not be the best method for improving driver safety of older drivers. Other programs such as the Car-fit program developed in the US, offering advice and...
education to older drivers or the TAC funded Community Mobility Program may be of more benefit in improving older driver safety and awareness.

4. Driving simulators offer learner drivers with a disability a practical education based method of learning the skills for safe driving in a range of driving conditions, prior to on-road training. Interventions for improving driver safety in learner drivers without a disability, was not a focus of the Churchill Fellowship, however the potential to use simulators, as part of a school based education program should be investigated.

5. Medically impaired drivers and learner drivers in Australia, would benefit from access to driving simulators, however prior to recommending their widespread use, a number of issues have been identified that need to be addressed:

Issue 1: There is currently a lack of guidelines to ensure a consistent and valid approach to guide clinical practice in the use of driving simulators by occupational therapy driver assessors.

Recommendation:
Guidelines are required to address:
- protocol for initial simulator familiarization (eg. number of sessions, scenario content)
- techniques to reduce the likelihood of simulator sickness
- design of scenario content and related driving tasks/behaviours
- which measures to use if they are to contribute to the pre-driving assessment
- training requirements and qualifications of the operator

Issue 2: Purchase and maintenance costs of simulators and funding of sessions for patients. Driving simulators are an expensive item of equipment and would be unaffordable for the many OTDAs working in private practice. Likewise many healthcare centres may not have the financial resources to purchase a driving simulator and cost of sessions may make them inaccessible to many Australians. In addition there are ongoing costs for maintenance and upgrading of software which need to be considered.

Recommendation:
It is recommended that specialized ‘driving’ centres throughout Australia be developed, where drivers with a disability could access driving simulators at no or low cost. A range of driving related services could be offered in the one location. The aim of the centres would be to contribute to prevention of road trauma, by improving driver safety and service delivery for all Australians with a disability who wish to drive. In Victoria this might be achieved by approaching organisations such as TAC and RACV for funding or collaborating with the service provided by the Independence Living Centre. In addition, this recommendation may fall within the scope of VicRoads Road Safety Action Plan 2016-2020.

Issue 3: There is a lack of training opportunities for clinicians in Australia to learn about driving simulators. From my discussions with clinicians and researchers, this is an issue that is also relevant overseas.
**Recommendation:**
The text book edited by Dr Classen, to be published in 2017, will make a significant contribution to informing clinical practice in the use of driving simulators. In addition, a training course/workshop would need to be developed for OTDAs, if driving simulator use becomes more widespread in Australia. The content would be based on recommendations from Dr Classen’s textbook and current research. The course could be run in each state, as professional development for OTDAs by Occupational Therapy Australia.

**Issue 4:** There are a lack of programs in Australia such as Car-fit (offering driving related advice to older drivers) or the Mobility Road Show (offering the opportunity to view and trial a range of modified vehicles and adaptive equipment). It is acknowledged that it may be difficult to support these types of programs due to Australia’s geographical size and smaller population.

**Recommendation:**
Development of specialised ‘driving’ centres throughout Australia as outlined above, that offer similar services/programs is recommended.

**Issue 5:** To obtain a range of driving related services and specialist knowledge, clients currently need to visit a number of locations and/or specialists. Firstly to obtain a driving assessment, secondly to receive driver rehabilitation and training, and thirdly to obtain information about any vehicle modifications they may be required. There is limited opportunity in Australia to trial and be trained to use more high-tech adaptive equipment.

**Recommendation:**
The ‘one-stop shop’ approach described above would enable all driving related services to be offered in the one location. It is recommended that the following resources be offered:
- Specialist OT driver assessors and driving instructors to provide driver assessment, rehabilitation and advice.
- Driving simulators fitted with vehicle modifications
- Modified vehicles to provide a range of adaptive equipment options to enable assessment, training and the option to ‘try before you buy’.
- ‘Car-fit’ or similar program offering advice and assessment for older drivers, including training to use assistive technology now available on new cars.
- Assessment and training program for learner drivers with a disability.

In summary, a range of driver rehabilitation services are currently available in Australia, but they can be difficult to access due to location and cost. Driving simulators are not currently available in most driver rehabilitation programs. This situation could be significantly improved by developing specialised driving centres, offering a ‘one-stop shop’, approach similar to those available overseas. It is acknowledged that funding would need to be sought to set up such centres. The costs may be outweighed by the benefits in improved road safety and driving related services for older Australians and those with a medical impairment. The Churchill Fellowship has provided me with knowledge to contribute to and assist in implementing these recommendations.
Useful References


